

PATENT ABSTRACTS OF JAPAN

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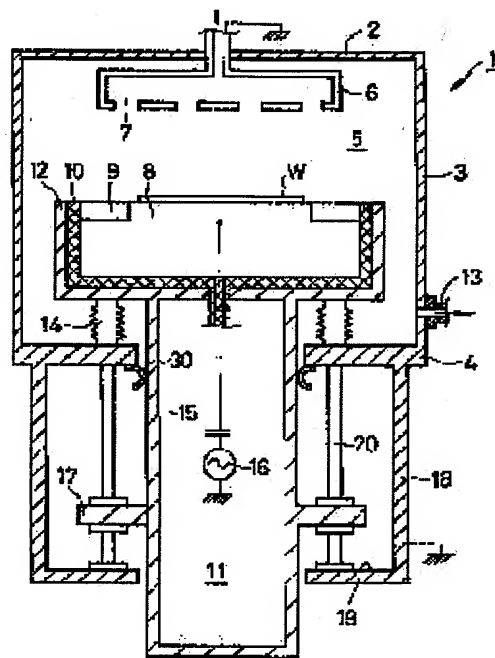
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(54) PLASMA PROCESSING DEVICE

(57)Abstract:

PURPOSE: To enable a circuit which feeds an RF power to a lower electrode to be formed and to prevent external noises and an abnormal discharge by a method where in a lower electrode support table and the conductive wall of a processing chamber are pressed by an elastic member vertical to the direction in which the lower electrode support table moves up or down.

CONSTITUTION: The base wall 4 of a processing chamber 5 and the lifter 15 of a lower electrode support table 11 are electrically connected together by an elastic member 30 which exerts its elastic force so as to press the lower electrode support table 11 vertical to the direction in which the lower electrode support table 11 moves up or down. By this setup, even if the base wall 4 of the processing chamber 5 and the lifter 15 of the lower electrode support table 11 are changed in relative positional relation between them due to the vertical movement of the lower electrode support table 11, the elastic member 30 is always kept in contact with the lifter 15 by pressure, so that the base wall 4 and the lifter 15 can be surely, constantly, and electrically connected together.



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[Claim(s)]

[Claim 1] The processing room which consists of the grounded conductive wall, and the lower electrode connected to the RF generator while being installed in the processing interior of a room and insulating with the conductive wall of the processing room electrically, In plasma treatment equipment equipped with the lower electrode susceptor which you insulate [susceptor] with the lower electrode electrically, and makes it go up and down the lower electrode Plasma treatment equipment characterized by making it flow electrically by the elastic member on which elastic force acts so that the above-mentioned lower electrode susceptor may be pressed in the direction which carries out the abbreviation rectangular cross of the above-mentioned lower electrode susceptor and the conductive wall of the above-mentioned processing room to the rise-and-fall direction of the above-mentioned lower electrode susceptor.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the structure for starting plasma treatment equipment, especially obtaining an electric flow with the lower electrode susceptor of this equipment, and the conductive wall of a processing room.

[0002]

[Description of the Prior Art] It is possible for you to make it go up and down the lower electrode installed in the processing interior of a room with bellows conventionally, as plasma treatment equipment is shown in drawing 6 , and by making it go up and down a lower electrode by the suitable driving means, it is constituted so that the relative distance between an up electrode and a lower electrode can be adjusted.

[0003] A lower electrode and lower electrode susceptor are insulated electrically here, and in order to prevent generating of an external noise or abnormality discharge, it is necessary to hold equally the potential difference of lower electrode susceptor and the conductive wall of a processing room, and to ground it. However, since the relative location between lower electrode susceptor and the conductive wall of a processing room changed with rise-and-fall movement of lower electrode susceptor, it was difficult to secure a positive electric flow path among both.

[0004] Therefore, as shown in drawing 6 and drawing 7 , even when lower electrode susceptor carried out rise-and-fall movement and the relative location of the pars-basilaris-ossis-occipitalis wall of a processing room and lower electrode susceptor changed by connecting the pars-basilaris-ossis-occipitalis wall and lower electrode susceptor of a processing room by the conductive member 100 of a filament, for example,

copper wire etc., it consisted of conventional equipment so that electric switch-on might be held among both.

[0005] However, in order to obtain good electric switch-on, while many filament members needed to be wired between lower electrode susceptor and the pars-basilaris-ossis-occipitalis wall of a processing room, consequently the manufacture assembly of equipment became complicated, there were many problems also at the time of a maintenance. In order to use a further again comparatively long filament member, it was a configuration with the electric flow path inadequate for becoming comparatively long and suppressing generating of an external noise or abnormality discharge completely which ties lower electrode susceptor and the pars-basilaris-ossis-occipitalis wall of a processing room.

[0006] The stray capacity of wiring which makes it flow through between electrode susceptor and a processing room when the physical relationship between lower electrode susceptor and the conductive wall of a processing room furthermore changes, and an inductance changed, and since [to which RF supply frequency to a lower electrode becomes high] it became impossible to take and ignore, as for the impedance by this stray capacity and the inductance, the repeatability of plasma treatment was hard to be acquired.

[0007]

[Problem(s) to be Solved by the Invention] The place which this invention is made in view of the above troubles which a Prior art has, and is made into the purpose Irrespective of the physical relationship of lower electrode susceptor and the conductive wall of a processing room, the electric flow relation between both is secured in a comparatively short path. It is the thing [it is possible to form RF supply circuit to a lower electrode certainly, and] which there is also a shielding effect, therefore can prevent generating of an external noise or abnormality discharge beforehand and for which new and the improved plasma treatment equipment are offered.

[0008]

[Means for Solving the Problem] The processing room which consists of the grounded conductive wall according to this invention in order to solve the above-mentioned technical problem, The lower electrode connected to the RF generator while being installed in the processing interior of a room and insulating with the conductive wall of the processing room electrically, In plasma treatment equipment equipped with the lower electrode susceptor which you insulate [susceptor] with the lower electrode electrically, and makes it go up and down the lower electrode The plasma treatment equipment characterized by making it flow electrically by the elastic member on which

elastic force acts so that the above-mentioned lower electrode susceptor may be pressed in the direction which carries out the abbreviation rectangular cross of the above-mentioned lower electrode susceptor and the conductive wall of the above-mentioned processing room to the rise-and-fall direction of the above-mentioned lower electrode susceptor is offered.

[0009]

[Function] According to this invention, by making it flow through lower electrode susceptor and the conductive wall of a processing room directly electrically by the elastic member, without using the conductive member of a filament like before Since the electric flow path which ties the above-mentioned lower electrode susceptor and the conductive wall of the above-mentioned processing room can form short RF circuit certainly irrespective of the relative location of the above-mentioned lower electrode susceptor and the conductive wall of the above-mentioned processing room Generating of an external noise or abnormality discharge can be prevented effectively.

[0010]

[Example] It explains referring to an accompanying drawing about one example of the plasma treatment equipment constituted based on this invention below. The plasma treatment equipment 1 constituted based on this invention as shown in drawing 1 is equipped with the processing room 5 airtightly constituted with the top wall 2, the side attachment wall 3, and the pars-basilaris-ossis-occipitalis wall 4 made from aluminum. The up electrode 6 is installed in the upper part of the processing room 5. The raw gas supply path 7 is installed inside by the up electrode 6, and the raw gas supplied through the massflow controller which is not illustrated from the source of raw gas which is not illustrated is introduced in the above-mentioned processing room 5 through two or more holes 7 drilled in the inferior surface of tongue of the above-mentioned up electrode 6.

[0011] Moreover, the lower electrode 8 is installed down the above-mentioned processing room 5. In the top face of this lower electrode 8, it is possible to carry out installation immobilization of the processed object W, for example, the semi-conductor wafer, with a suitable fixed means, for example, an electrostatic chuck. Moreover, the focal ring 9 is installed so that the processed object installation side of the above-mentioned lower electrode 8 may be enclosed, and the perimeter and pars basilaris ossis occipitalis of the above-mentioned lower electrode 8 are further supported by the lower electrode supporter 12 of the lower electrode susceptor 11 made from aluminum, for example, a product, through the insulating member 10. Moreover, it is open for free passage to the vacuum pump which is not illustrated down the above-mentioned processing room 5, and the exhaust pipe 13 which can carry out evacuation of the inside of the

above-mentioned processing room 5 is installed.

[0012] Furthermore between the inferior surface of tongue of the above-mentioned lower electrode supporter 12, and the top face of the pars-basilaris-ossis-occipitalis wall of the above-mentioned processing room 5, the elastic bellows 14 made from stainless steel is arranged, and even if it is the case where the above-mentioned lower electrode susceptor 11 carries out rise-and-fall movement, the inside of the above-mentioned processing room 5 is held airtightly. Moreover, the rise-and-fall section 14 of the shape of a cylinder of the above-mentioned lower electrode susceptor 11 is attached in the center section of the above-mentioned lower electrode supporter 12, and RF generator 15 is arranged to the interior at the above-mentioned lower electrode susceptor 11 and an electric insulation condition.

[0013] Moreover, the flange 17 is formed in the perimeter of the lower part of the above-mentioned rise-and-fall section 14. The screw hole is drilled at suitable spacing for this flange 17, and the screw shaft 20 set up by that screw hole on the top face of the base 19 of the susceptor 18 of the above-mentioned processing room 5 is installed. It is constituted to go up and down the above-mentioned lower electrode 8 so that it may be possible to carry out a rotation drive with the driving gear which does not illustrate the above-mentioned screw shaft 20.

[0014] In the plasma treatment equipment constituted as mentioned above, in order to decide RF supply circuit, it be necessary to secure an electric flow path between the rise and fall section 15 by the pars basilaris ossis occipitalis wall 4, and the above-mentioned lower electrode susceptor 11 and the example of illustration in the wall of the above-mentioned processing room 5 which consisted of conductive ingredients, such as aluminum, and the example of illustration.

[0015] Therefore, as shown in drawing 6 and drawing 7, even when lower electrode susceptor carried out rise-and-fall movement and the relative location of the pars-basilaris-ossis-occipitalis wall of a processing room and lower electrode susceptor changed by connecting the pars-basilaris-ossis-occipitalis wall and lower electrode susceptor of a processing room by the conductive member 100 of a filament, for example, copper wire etc., it consisted of conventional equipment so that electric switch-on might be held among both.

[0016] However, in order to obtain good electric switch-on with the above configurations, while many filament members needed to be wired between the above-mentioned lower electrode susceptor 11 and the above-mentioned pars-basilaris-ossis-occipitalis wall 4 of the above-mentioned processing room 5, consequently the manufacture assembly of equipment became complicated, there were many problems also at the time of a

maintenance. Since a further again comparatively long filament member was used, the electric flow path which ties the above-mentioned lower electrode susceptor 11 and the above-mentioned pars-basilaris-ossis-occipitalis wall 15 of the above-mentioned processing room 4 was not able to become comparatively long, and generating of an external noise or abnormality discharge was not able to be suppressed completely.

[0017] Then, according to this invention, it sets in the rise-and-fall direction of the above-mentioned lower electrode susceptor 11, i.e., the direction which intersects perpendicularly to a perpendicular direction, i.e., a horizontal direction. By the elastic member 30 on which elastic force acts so that the above-mentioned lower electrode susceptor 11 may be pressed By making it flow through the pars-basilaris-ossis-occipitalis wall 4 of the above-mentioned processing room 5, and the rise-and-fall section 15 of the above-mentioned lower electrode susceptor 11 electrically Since the elastic member 30 is always carrying out press contact to the above-mentioned rise-and-fall section 15 even if it is the case where both relative location changes with rise-and-fall movements of the above-mentioned lower electrode susceptor 11, it is possible to secure always positive switch-on.

[0018] Next, the structure of the elastic member 30 for an electric flow constituted based on this invention is explained, referring to drawing 2 . The member which bent like illustration as this elastic member 30 so that it might have the abbreviation configuration for J characters in a perpendicular direction cross section, the member, for example, the copper plate, which has elastic force by conductivity, can be used. It becomes possible by attaching a part for the shank 31 of this abbreviation configuration member 30 for J characters in the base of the pars-basilaris-ossis-occipitalis wall 4 of the above-mentioned processing room 5 with the suitable fixed means 32, for example, a screw means, to give desired elastic force, i.e., the elastic force which presses the above-mentioned lower electrode susceptor 11 horizontally, to a part for the bend 33 of the above-mentioned abbreviation configuration member 30 for J characters. Consequently, even if it is the case where the above-mentioned rise-and-fall section 15 of the above-mentioned lower electrode member 11 moves up and down, a part for the above-mentioned bend 33 of the abbreviation configuration member 30 for J characters will always be pressed by the front face of the above-mentioned rise-and-fall section 15, and an electric flow path is always secured among both members.

[0019] Another example of the elastic member shown in drawing 2 is shown in drawing 3 . Also in this example, the basic function of each part material will omit duplication of explanation by ***** which gives the same number to the elastic member shown in drawing 2 , and the member which does the same function so similarly therefore.

However, in the example of drawing 3 , the projection 34 prolonged in a perpendicular direction lower part is formed in the base of the above-mentioned pars-basilaris-ossis-occipitalis wall 4, the spring member 35 is attached in the field which counters the above-mentioned lower electrode susceptor 11 of the projection 34, and the press member 36 which can be rotated freely is further attached at the tip of the spring member 35. Thus, by pressing further the above-mentioned bend 33 of the above-mentioned abbreviation configuration member 30 for J characters to the above-mentioned lower electrode susceptor 11 by the press member 36, it becomes possible to acquire the electric contact stabilized more between the above-mentioned pars-basilaris-ossis-occipitalis wall 4 and the above-mentioned lower electrode susceptor 11.

[0020] Thus, as shown in drawing 4 , as for the constituted elastic member 30, it is desirable to install more than one at equal intervals between the above-mentioned pars-basilaris-ossis-occipitalis walls 4 of the above-mentioned processing room 5 and the above-mentioned rise-and-fall sections 15 of the above-mentioned lower electrode susceptor 11 which have been arranged in a horizontal section concentric circular. Even if it is the case where the relative location of the above-mentioned pars-basilaris-ossis-occipitalis wall 4 and the above-mentioned rise-and-fall section 15 changes by adopting this configuration, among both members, it becomes possible to secure the electric switch-on always stabilized more, and RF supply circuit for plasma treatment can be formed more certainly.

[0021] As shown in drawing 4 , in order to arrange two or more elastic members 30 in the shape of a circular ring, the copper Itabe material 40 of a pectinate form as shown in drawing 5 can be used. Namely, by incurvating the tip of the above-mentioned ctenidium section 42 in this direction, while connecting the both ends of the base 41 of the above-mentioned member 40 first, forming a coronary circular ring member at the time of manufacture assembly and, incurvating the above-mentioned base 41 subsequently to the method of outside It is possible to operate considering the above-mentioned ctenidium section 42 as a bend of the abbreviation configuration member 30 for J characters, and to operate the above-mentioned base 41 as a part for the shank of the abbreviation configuration member 30 for J characters. It is possible to insert the above-mentioned cylindrical shape-like rise-and-fall section 15 which has a bigger outer diameter than the bore of the ring into the ring which finally fixes the above-mentioned base 41 to the base of the above-mentioned pars-basilaris-ossis-occipitalis wall 4, and is formed of two or more above-mentioned ctenidium sections 42. Consequently, the above-mentioned ctenidium section 42 will

contact the above-mentioned rise-and-fall section 15 elastically, and becomes possible [always securing electric switch-on] irrespective of vertical motion of the above-mentioned rise-and-fall section 15.

[0022] As mentioned above, although the example which applied the plasma equipment based on this invention to the plasma etching system was explained, it is possible for the plasma equipment based on this invention not to be limited to the above-mentioned example, but to apply to an ashing device, a sputtering system, ion implantation equipment, plasma-CVD equipment, etc.

[0023]

[Effect of the Invention] since an electric flow path can form short RF circuit certainly irrespective of the relative location of the above-mentioned lower electrode susceptor and the conductive wall of the above-mentioned processing room by make it flow through lower electrode susceptor and the conductive wall of a processing room directly electrically by the elastic member according to the plasma treatment equipment constituted based on this invention as explain above , the outstanding effectiveness that generating of an external noise or abnormalities discharge can be prevent beforehand be do so .

5

続いて冠状の円環部材を形成し、次いで上記基部 4 1 を外方に湾曲させるとともに上記歯部 4 2 の先端を同方向に湾曲させることにより、上記歯部 4 2 を略 J 字形状部材 3 0 の湾曲部として、上記基部 4 1 を略 J 字形状部材 3 0 の軸部分として機能させることが可能である。最後に上記基部 4 1 を上記底部壁 4 の底面に固定し、複数の上記歯部 4 2 により形成される輪の中にその輪の内径よりも大きな外径を有する円筒形状の上記昇降部 1 5 を挿入することが可能である。この結果、上記歯部 4 2 が弾性的に上記昇降部 1 5 に接触することになり、

上記昇降部 1 5 の上下運動にかかわらず、常に電氣的導通状態を確保することが可能となる。

【0022】以上、本発明に基づくプラズマ装置をプラズマエッチング装置に適用した例について説明したが、本発明に基づくプラズマ装置は上記例に限定されず、アッシング装置、スパッタ装置、イオン注入装置、プラズマ CVD 装置などにも適用することが可能である。

【0023】

【発明の効果】以上説明したように、本発明に基づいて構成されたプラズマ処理装置によれば、下部電極支持台と処理室の導電性壁とを弾性部材により直接電氣的に導通させることにより、上記下部電極支持台と上記処理室の導電性壁との相対的位置関係にかかわらず、電氣的導通経路が短い RF 回路を確実に形成することができるので、外部ノイズや異常放電の発生を未然に防止できるといふ優れた効果を奏する。

【図面の簡単な説明】

【図 1】本発明に基づいて構成されたプラズマ処理装置の概略図である。

【図 2】図 1 に示すプラズマ処理装置のコンタクトフィンガ部分の拡大図である。

【図 3】本発明に基づいて構成されたプラズマ処理装置のコンタクトフィンガの別の実施例の拡大図である。

【図 4】本発明に基づいて構成されたプラズマ処理装置の下部電極支持台と処理室の導電性壁との電氣的導通経路部分の水平方向断面図である。

【図 5】本発明に基づいて構成されたプラズマ処理装置のコンタクトフィンガの組立部材の展開図である。

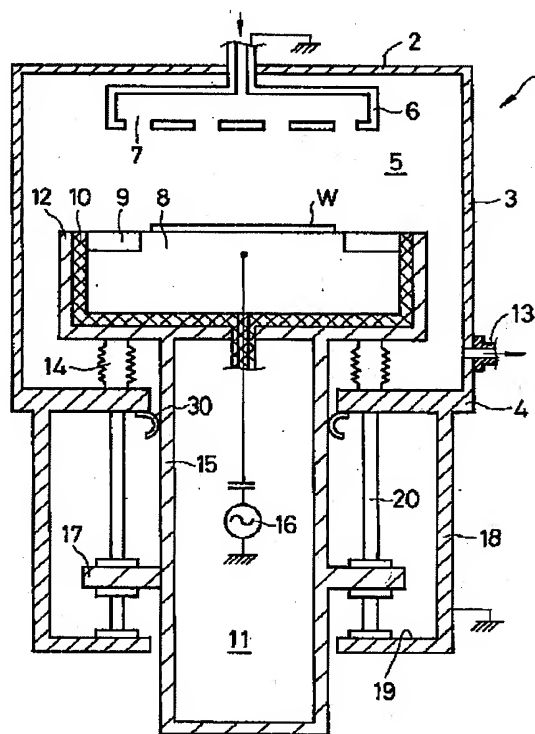
【図 6】従来のプラズマ処理装置の概略図である。

【図 7】図 6 に示すプラズマ処理装置の下部電極支持台と処理室の導電性壁との電氣的導通経路部分の拡大図である。

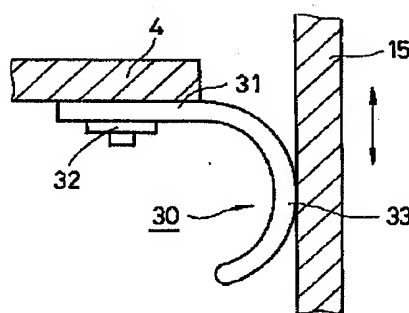
【符号の説明】

- 1 プラズマ処理装置
- 5 処理室
- 8 下部電極
- 20 絶縁部材
- 10 下部電極支持台
- 11 下部電極支持部
- 12 ベローズ
- 14 昇降部
- 30 コンタクトフィンガ

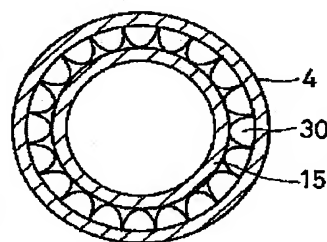
【図 1】



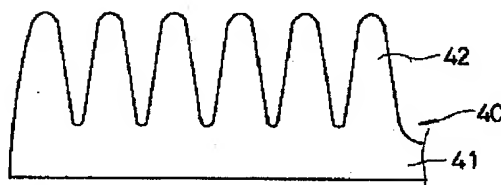
【図 2】



【図 4】



【図 5】



【図 3】



フロントページの続き

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